THE CHEMIST

July, 1959

VOLUME XXXVI

NUMBER 7

Dr. Vlon N. Morris, F.A.I.C., (seated)
Receives Honor Scroll of New Jersey Chapter from
Dr. Lawrence T. Eby, F.A.I.C.

(*See Page* 275.)

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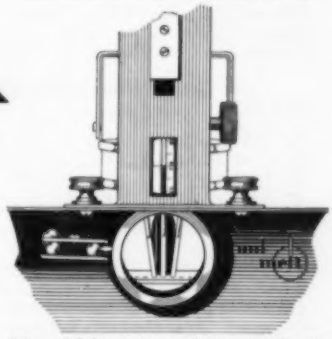

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Deadlines for THE CHEMIST: For the August issue the deadline is July 15.

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THE AMERICAN INSTITUTE OF CHEMISTS does not necessarily endorse any of the facts or opinions advanced in articles which appear in THE CHEMIST.

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TO COME IN AUGUST

"Perseverance—The Sinew of Life" is the philosophical pattern for the career which Dr. Maurice J. Kelley, F.A.I.C., of Nopco Chemical Co., Harrison, N. J., plans for his future. He outlined it when he received the Honor Scroll of the New York AIC Chapter. (We will observe his progress as time proceeds.) • Dr. B. D. Van Evera, dean for sponsored research, the George Washington University, Washington, D. C., who led the third professional session at the 36th Annual AIC Meeting, introduced the panel with pertinent remarks on "Scientific Training for the Economy." Committee reports presented at the 36th Annual Meeting will also appear.

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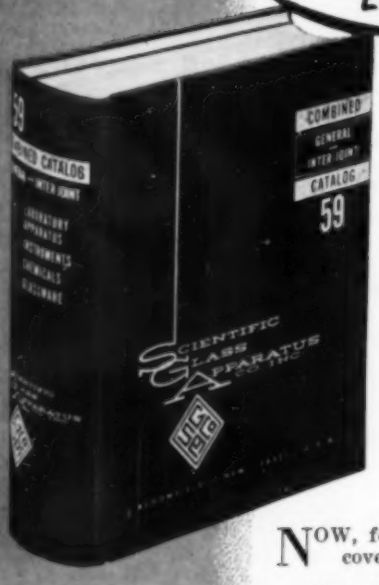

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EDITORIAL

Resolution Emphasizes Professional Status

CHEMISTS and chemical engineers are properly concerned over attempts to belittle their professional status or to "down-grade" them in the eyes of the public. The AIC was established to advance the professions of chemist and chemical engineer in the United States. It has made notable progress.

Consequently, the members of the AIC present at the 36th Annual Meeting held in Atlantic City, N.J., May 7, took specific action in the form of a Resolution to counteract current reports that chemists and chemical engineers were not truly professional people, and that their needs could be satisfied by labor unions.

This resolution re-emphasized professional status, and the alert, continued activities of the AIC to improve the professional status that is due the chemist and chemical engineer from employers and the public.

Resolution

WHEREAS, it has come to the attention of chemists and chemical engineers that at a recent AFL-CIO Conference on Labor and Science in a Changing World, held in Washington, D.C., the following were among the points made during a panel discussion on "Meeting the Needs of Scientific and Professional Workers":

Unions must push the idea that industrial scientists and engineers are no longer professionals. Because they are so numerous, they are now mere employees and need the powers of collective bargaining . . . Professional society activity must be countered by an educational program that shows membership in a trade union is not unprofessional.

WHEREAS, THE AMERICAN INSTITUTE OF CHEMISTS was organized for and is dedicated to the advancement of chemists and chemical engineers as professionals; and

WHEREAS, THE AMERICAN INSTITUTE OF CHEMISTS recognizes that professional approaches are superior to the labor union approach to secure for chemists and chemical engineers the best advancement in professional and economic status; and

WHEREAS, We believe professional activities should be rewarded because of merit and not because of seniority, and further, we believe that in any free society, professionals should not be forced to join or be barred from joining any organization for which they qualify, either by legal or other means;

THEREFORE, BE IT RESOLVED, that THE AMERICAN INSTITUTE OF CHEMISTS at its 36th Annual Meeting in Atlantic City, N. J., May 7, 1959, declares that it is opposed to any attempt of organized labor to unionize chemists and chemical engineers. Further, that the Institute will use all of its powers to promote vigorously for qualified chemists and chemical engineers that advancement in status due them from employers and the public.

Special AIC Announcements

New York Chapter Elections

The New York AIC Chapter announces that the following officers will serve for the 1959-60 fiscal year:

Chairman, Dr. E. J. Durham, director, William H. Nichols Lab., New York University, New York 53, N. Y.

Chairman-elect, Dr. John L. Hickson, assistant to president, Sugar Research Foundation, 52 Wall St., New York 5, N. Y.

Secretary, Dr. Kurt S. Konigsbacher, Evans Research & Development Corp., 250 E. 43rd St., New York 17, N. Y.

Treasurer, Dr. Pauline Newman, Food Machinery & Chemical Corp., 161 E. 42nd St., New York 17, N. Y.

National Council Representative, George F. Foy, Fine Chemicals Div., Shulton, Inc., Clifton, N. J.

Western Chapter Honors Dr. Allard

The Honor Scroll of the Western AIC Chapter was presented to Dr. R. P. Allard, chairman, Department of Chemistry, Loyola University, Los Angeles 45, Calif., at a meeting held at the Hotel Green, Pasadena, Calif., May 27. He was cited for his untiring efforts in behalf of the Western Chapter and his enthusiastic support of the professional status of chemists.

Testimonial Dinner to Dr. Muenzen

Dr. Joseph B. Muenzen, S.J., F.A.I.C., associate professor, Canisius College, Buffalo, N. Y., was honored, May 26, at a testimonial dinner given by the Niagara AIC Chapter, held at the University of Buffalo. He was cited for his many services to the Chapter. Dr. Muenzen spoke on "Salt — Its Importance in the History of Mankind."

Officers for Twin City Chapter

The Twin City AIC Chapter has elected the following officers for 1959-60:

Chairman, Dr. Joseph F. Abere, Minnesota Mining & Mfg. Co., St. Paul 6, Minn.

Vice chairman, Henry L. Weisbecker, Minnesota Mining & Mfg. Co., St. Paul 6, Minn.

Secretary, Mrs. Rosemary Breiland, Twin City Testing & Engineering Lab., 2440 Franklin Ave., St. Paul, Minn.

Treasurer, W. W. Benton, 2069 Watson Ave., St. Paul 16, Minn.

National Council Representative, Dr. John L. Wilson, Economics Lab., Inc., St. Paul 1, Minn.

Alternate Council Representative, Morris Kenigsberg, The Toni Co., 332 Rosabel St., St. Paul 1, Minn.

Niagara Chapter Officers

The following officers have been elected by the Niagara Chapter for 1959-60:

Chairman, Lyle J. Mahar, Coke Over Lab., Bethlehem Steel Co., Lackawanna, N. Y.

Chairman-elect, Dr. J. Frederic Walker, Electrochemicals Dept., E. I. duPont de Nemours & Co., Niagara Falls, N. Y.

Secretary, Dr. Howard W. Post, professor, Chemistry Dept., University of Buffalo, Buffalo 14, N. Y.

Treasurer, Ray F. Seifert, Titanium Alloy Mfg. Co., National Lead Co., Niagara Falls, N. Y.

National Council Representative, Clarence A. Weltman, Alox Corp., P.O. Box 556, Niagara Falls, N. Y.

Honorary AIC Membership Presentation

The presentation of Honorary AIC Membership to Dr. Jack P. Montgomery, AIC Charter Member, professor emeritus, The University of Alabama, will be made on September 26, at a meeting of the Alabama AIC Chapter to be held at the Stafford Hotel, Tuscaloosa, Alabama.

To AIC Members

The Committee on Licensing would like to have your comments on its report. Please see page 280.

Professional Appointments

July 17, 1959, Clearwater, Florida. The Fort Harrison Hotel. Florida AIC Chapter. First meeting. 6:30 p.m. Election of Officers, adoption of Constitution. For information, D. H. Killeffer, P.O. Box 443 Clearwater, Fla.

Sept. 26, 1959. Tuscaloosa, Alabama. Stafford Hotel. Alabama AIC Chapter Meeting. Presentation of Honorary AIC Membership to Dr. Jack P. Montgomery, AIC Charter Member, professor emeritus, The University of Alabama.

Sept. 29, 1959. Kansas City, Mo. Rockhurst College. Midwest AIC Chapter meeting. Dinner (cafeteria) 6:30 p.m. Meeting 7:30 p.m. Panel Theme: "Professional Opportunities for Students of Chemistry." Moderator, Dr. A. Ernest MacGee.

Oct. 1, 1959. Chicago, Ill. Chicago AIC Chapter Meeting. Presentation of the Honor Scroll of the Chapter to Dr. Johan Bjorksten, F.A.I.C., president, Bjorksten Research Labs., Madison 1, Wis. AIC President, Dr. Wayne E. Kuhn, will present the Scroll.

Nov. 30, 1959. Kansas City, Mo. Rockhurst College. Midwest AIC Chapter meeting. Dinner (Cafeteria) 6:30 p.m. Meeting 7:30 p.m. Annual Elections.

May 11-13, 1960. Minneapolis, Minn. Radisson Hotel. 37th Annual AIC Meeting. The Twin City Chapter will be our host.

May 11-12, 1961. Washington, D. C. Statler Hotel, 38th Annual AIC Meeting. The Washington Chapter will be our Host.

The Eastern New York Chapter of the American Society for Metals will sponsor a conference on the "Fracture of Engineering Materials," August 23-25, on the Rensselaer Polytechnic Institute campus, Troy, N. Y. For information: J. H. Keller, General Electric Research Lab., Schenectady, N. Y.

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How Science Came to the Journalists

Thomas R. Henry
Science Writer, "Evening Star-Sunday Star," Washington, D.C.

(Acceptance address when the author received the Honor Award of the Washington AIC Chapter, May 27, 1959, at the Army-Navy Club, Washington, D.C.)

MY associations with science have been almost entirely those of a newspaper reporter. I have covered the "news" of science, locally, nationally and internationally, for approximately thirty-five years. It has been an almost unique privilege—that of witnessing probably the most remarkable, sensational and meaningful episode in the history of the human race.

When I was a boy in Massachusetts, the way of life of the average New England farmer differed far less from the way of life of the average Judean farmer at the time of the birth of Christ than it differed from that of the average New England farmer today.

True, there were differences then —heraldic differencces. Telegraph, telephone, even the automobile, already were in existence somewhere. There was a single telephone at the village post office. It was seldom used because most folks were afraid to try to operate it. I was almost through high school when the first automobile appeared, that of the town doctor. His practice suffered because of it. He had to spend so much of his time "getting out and getting under," as the old song went, that he hardly could make his daily rounds and answering an emergency call was almost impossible.

—Hessler Studio

Thomas R. Henry

A group usually collected when, covered with sweat and with badly blistered hands, he tried to crank his car. They laughed at the poor man's sufferings. Civil War veterans—some still in early middle age—gathered on the post office steps and exchanged cynical comments. They felt this was their right. Except for them few ever

had been outside the village, even as far as the neighboring city of Worcester.

From this—and I don't think I have exaggerated too much—we have come in a little more than a half century to atomic bombs, jet planes, inoculations against man's major illnesses, and all the rest. The progress has continuously gathered momentum, to the point where for some years past it has attracted the attention of that most conservative class of our citizens, the journalists.

This progress has been due to all the sciences, but, in its physical aspects at least, primarily to the basic disciplines of chemistry and physics.

Thirty-five years ago one had to "dig," in newspaper parlance, for a science story. First, there were not too many current developments of general interest. Second, newpapers were not very hospitable. It hardly can be denied that most editors, especially managing editors, city editors and copy readers, lived in a world about as far from scientific interests as one could imagine. It was hard for them to believe that any reader could be interested in such dry, abstruse stuff. The scientist was a rather absurd, long-bearded, absent-minded fellow whose place, so far as newspapers were concerned, was in the funny columns.

I recall very well when Watson Davis, just before the establishment of Science Service, "sold" the idea of a science column to the publisher of the old *Washington Herald*, now long defunct. The publisher at the time happened to be an exceptionally intelligent man. The managing editor, the news editor, the city editor were indignant. It just showed, they said, how stupid and ignorant of the fundamentals of newspaper work this man was. They protested so much that he finally agreed to drop the column, to keep peace in the family, and to substitute a fourth rate humor column.

I cannot illustrate better the change that has taken place than to ask you to look at the *Post* or the *Star*. I venture to say each contains five or six science stories, at least one of which is on the front page. It would be an exceptional day when this was not the case. If it did not happen it would indicate very poor journalism on the part of the editors in Washington whose most widespread and important activity is research. Science almost certainly exceeds politics in public interest here.

When the National Association of Science Writers first was established about 25 years ago there were ten charter members—about all that could be scraped together in the United States. One or two of these only covered science quite incidentally, perhaps on the way to and from their more important police station beats. I have not counted the members lately, but there are something like 250,

all engaged full time in reporting science for American newspapers.

Journalism has been forced, at first quite against its will, to recognize science. Science also has been forced to recognize journalism, as is evidenced by the host of public relations people now employed by all sorts of science organizations and the vast number of handouts everybody in this business gets every week.

Has this rapprochement been for good or bad? I think, in ways, for both. But it has contributed to public understanding and it has contributed to the progress of science.

Washington Chapter Honors Thomas R. Henry

THE 1959 Honor Award Scroll of the Washington AIC Chapter was presented to Thomas R. Henry, science writer, at a dinner held at the Army-Navy Club in Washington, D. C., May 27.

Mr. Henry, after World War I, was reporter, news editor and editor of the *Washington Herald*. He joined the staff of the *Evening Star-Sunday Star* in Washington in April 1922, and has been associated with this newspaper ever since.

He was born at Boston, Mass. He received the A.B. degree from Clark University and the M.A. from George Washington University. His column, "Vistas of Science," formerly known as "Stars, Men and Atoms," is regularly published on the *Star* editorial page. He is the author of several books and scientific articles which have appeared in the *Saturday Evening Post, National Geographic, Popular Science,* and other magazines. "Progress in Isotope Research," a series in the *Star,* was reprinted for the Atomic Energy Commission.

He was awarded the Pulitzer Prize Honorable Mention, the Westinghouse Science Writing Award, and the Medal of Freedom by General Eisenhower. Mr. Henry is past president of the National Association of Science Writers, a member of the Explorers' Club, the Washington Academy of Sciences, the Cosmos Club, and the National Press Club.

Dr. Carl J. Wessel, chairman of the Washington AIC Chapter, presented the Honor Award to Mr. Henry. Dr. Emil Ott, then AIC president, brought greetings from the national AIC. Dr. Benjamin M. McKelway, editor, *The Evening Star,* gave the invitation address.

The citation to Mr. Henry reads:

In recognition of his service to science as a professional writer and author, and his ability and untiring efforts in keeping the public informed of important and noteworthy advances in science through the press.

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Delaware Chapter's Program Praised

To the Editor:

On a vacation trip I received the May issue of THE CHEMIST and read with great interest the "Program of Objectives of the Delaware AIC Chapter." I can only congratulate the Chapter for the wonderful and really positive standpoint in these vital questions.

I would add that this is not only a problem for one chapter or for one professional society. These are questions for all academic professions, therefore for all professional societies. Why do they not close their ranks and fight together with all the power in their ability?

The AIC must take steps to bring all the paragraphs of this above mentioned program to life.

—Dr. Robert Lobstein
(Mailed from London, England)

Can Some One Answer This?

I would appreciate it if you could advise me where I can get all possible information on the Atmospheric Railway. I understand this was in operation between Kingstown and Dalkey, Ireland, in 1844 and 1845. I heard it was later taken up by the English who operated a similar railroad. All information on where I can obtain related data will be appreciated.

—Richard McCoy
Hotel De Vargas, Santa Fe, New Mexico

Research in Government and Industry

Lt. Gen. James M. Gavin (USA Ret.)

Executive Vice President, Arthur D. Little, Inc., Cambridge 42, Mass.

(Presented at the 36th Annual AIC Meeting, Atlantic City, N. J., May 7, 1959)

MY SUBJECT is the need to integrate and support all of our scientific resources in the national interest. The background for these remarks is war. We are in the midst of war now, and no cold war, but a very hot economic competition. Khrushchev has declared war on us in the realm of trade. We have been feeling the effects of the Soviet economic offensive for almost a year.

Today, Russian benzene is being imported at a price which undercuts domestic sellers by four cents a gallon. In the world markets the Russians have undercut the prices of aluminum, wood-pulp, other products, and recently we have seen what they can do in the mass manufacture of high quality and cheap teaching instruments imported for use in our science classes.

With the flexibility of its economic machine, and by exploiting its people, the Soviet Union can issue its challenge to us in any market. If we are to survive we must capitalize on all our economic assets in this battle of rubles and dollars, raw materials and factories, laboratories, and — most important — intellect. Science and technology are the main instruments of survival.

The Soviets have understood this, and would present little threat to us now if it were not for their massive recruitment of scientific and technical forces. In a few years they have attained an industrial stature which allows them to seriously challenge us. Khrushchev has challenged us to trade — no empty challenge, since their central economic control and low standard of living will allow them to undersell us in specific areas of their choice. Yet trade we must, for our own good, and for the ultimate good of people all over the world. For there is a positive aspect to this competition between industrial giants. We are competing to supply good products cheaply. We are bringing new materials and methods of manufacture into being. Science is enriching the world, and the competition of the Soviet Union and the United States can be also a war against poverty and disease.

It is a new kind of war, disguised in the mask of uneasy peace. Because there is no drama of military battle, many people do not recognize this war. They think of the armed clashes of yesterday and overlook the somewhat strange battle of today. It may be that the world changes too rapidly

for most of us. We often wait until tomorrow to see the meaning of today's events. Tomorrow, perhaps, people will take for granted this extraordinary, seemingly non-military war we are waging. But this will be too late — possibly disastrous.

Today people seem to take even the most startling technical progress very much for granted. In a cartoon in a recent *New Yorker,* an indignant matron is standing by the ticket desk of an air terminal. Her husband, slightly apart, waits in controlled embarrassment while she exclaims, "If God intended us to fly in jets, He would have seen to it that the Wright brothers *invented* jets." There are many anecdotes like this. They show a very widespread misconception about the birth of new and complex products. Many people feel that major technical breakthroughs proceed from the miraculous talent and ingenuity of one or two men. Though largely true in the 19th century, it is not true in the 20th century. With few exceptions our major technical innovations come from a large reservoir of basic and applied research. Before we could make practical use of the brilliant aerodynamic ideas which led to jets, we needed the work of numerous applied scientists; we needed testing instruments, engineering, means of production. To our children this achievement will seem as routine as the incandescent lamp does to us. But the network of scientific labors that produced our jets is a good example of technical progress.

In commercial jet liners, we also see an outgrowth of military research. During the past 25 years government-supported research has contributed a great deal to civilian business. Our commercial aircraft industry emerged from the aeronautical work of World War I. From World War II came many medical achievements. The huge electronics and communications industries grew from wartime work. Transistors were developed. Radar and TV came into being. From wartime and postwar government projects, we added computers and servomechanisms to the grand battery of tools our modern industry needs.

These have given us automatic controls, data-processing machines, many refined instruments for research. From projects on chemical research, synthetics have evolved, plastics, new materials, drugs, new processes. Among them is the zone melting method of purifying germanium and silicon transistor materials which was developed to meet a military need for compact, reliable electronic equipment. This process may aid our chemical industries in producing very pure chemicals. Daily we read of progress in the use of atomic energy. Twenty years ago, even 5 years ago, nobody thought our atomic projects would have nearly so many commercial potentialities.

Just a few years ago we wondered

what the vast missile and space technology could contribute to our commercial markets. Now we have jet mining, both in stone quarrying and in extracting our taconite ores. From the development of infra-red for guidance and radar systems a whole field has opened up, and industry has received very sensitive new tools for quality and process analysis. The applications of space technology are reaching even to the human heart, where miniature valves may in time be used to replace worn-out parts. From a missile fuel, hydrazine, we have a new drug for mentally depressed patients. The economic impact from the peaceful uses of military research is enormous, especially through the generation of new industry, and indirect effects.

Industrial research has reciprocated to the government by supplying plants and skilled personnel for military projects and by advancing our technical know-how. The development of a commercial aircraft industry during the late '20's and '30's was of crucial importance at the beginning of World War II. Today, the new processes evolved by the petroleum industry, especially the use of control instruments, gives us a continuous flow of high quality petroleum products at low prices. Without these automatic processes, Eugene Ayres has said, "We would be faced with social disaster." We would have to return to the oil refining techniques of the 1920's, and we could not supply the quantities of high quality petroleum products that our industrial plants consume. The research and development of the electronics industries has been notably extensive and has contributed heavily to our space technology.

Briefly, there are a few general consequences of prime importance to the government. Industrial research creates revenue. Research is profitable, not only to individual companies, but in increasing our tax base. Industrial research accelerates our productive capacities, creates technical skills, offers new opportunities for employment. If our wealthy nation has become notably wealthier since the 1940's — and we are unique in that our rising birth rate has not meant a lower standard of living — then the key factor in our economic growth is research and development.

The chemical industries have been prominent in the amount of their scientific work. According to the National Science Foundation, one quarter of our industrial investment in research last year was made by the chemical industry. Moreover, the chemical industries invested a tenth of this money in basic research . . . Basic research is the cornerstone of our technical progress.

You will remember, toward the end of World War II, how impressed we Americans were with our technical power. In the mid-forties several

committees of scientists, under the direction of Dr. Vannevar Bush, got together to evaluate what our scientists had accomplished and how we should amplify our scientific resources in the future, so that no emergency would again catch our country unprepared. This famous report began with mention of advances in applied science — radar, rockets, transportation, medicine. Yet, despite the magnitude of our wartime technical accomplishments, Dr. Bush commented, "We have been living on our fat." To attain our goal, "We had to give up fundamental research and so we had to sacrifice the future to the present."

Until quite recently basic research was not at all an avenue of industry. This is understandable, since an investment in basic discovery is a gamble. The outcome of basic research is unpredictable. Its applications may not be apparent immediately, even to the pioneering scientists.

Basic research is difficult to manage. In a sense it must be supported, not managed. At the same time, an investor is only human, and when he is asked to support work on a basic discovery, he will demand: "What good is it?" Someone asked that question about one of Maxwell's important discoveries. He replied, "What good is a baby?"

No one need tell us that our babies are our future, but we have sometimes forgotten that basic research will shape our future. In the last 10 years we have been supporting it more generously. Educational and non-profit institutions have done the most, about 60%, of our basic research, the government 10%, and industry about 30%. Our total research and development budget is upwards of $10 billion annually. While these are impressive figures, we still have to ask whether we are giving science enough, and the right kind, of support.

While we, here, take much for granted and complain of taxes, the Soviets are putting the heat on. They announce that they are ahead of schedule on their 7-year plan, and their economy is growing at a rate of about 8% a year, while we proceed at little better than 2%. Their chemical industry, like their industrial capacity, has grown to between 1/3 and 1/2 of ours. The heat is on, indeed!

Let me indicate the nature of their scientific and technical momentum. At a recent Soviet Chemical Congress, it was clear that their polymer research had produced remarkable results. According to *Chemical Week*, they have discovered polymers with semi-conductor properties; have developed a new fertilizer 5 to 6 times as nutritive as the usual kinds and will not wash out of the soil. In these promising areas, the Russians are planning a concentrated program of research and development. Their chemical industry is being automated. They are increasingly employing continuous rath-

er than batch methods. All of their chemical industries share in the advances made by central research laboratories. A central oxygen research group, for example, is feeding new information to plants all over the country. Gaseous oxygen plants have been constructed to enhance metallurgy and the production of fuels and such basic products as ammonia and nitric acid, and a number of inorganic chemicals. The wholesale adoption of new methods too quickly has disadvantages, but we notice that this method lets the entire country benefit, not just a segment.

By no means is all of this rapid technical progress native to Russian science. The Soviets are soaking up all they can of the world's scientific produce. Even Khrushchev pocketed everything he could lay hands on in the U.S. exhibit in Moscow... They are trying to skim the cream from the whole world's R & D efforts, and they are doing this thoroughly and with dispatch. Their central technical information service employs over 2000 full-time people and 20,000 part time workers, who abstract and translate technical articles from the outside world. The Express Information Service has these articles ready for Russian scientists about 4-6 months after publication. The best of our own diverse services, *Chemical Abstracts*, has only 1700 part-time workers, and takes a year to prepare foreign articles for us.

Scientific Areas that Need Support

Here is one well-defined area in which we must integrate our activities and think as a nation instead as separate technical groups.

What are some of the other areas? Power sources are being thoroughly investigated by the Soviets. They are working on solar power; producing electricity from geothermic energy; investigating atomic power and unusual chemical sources. In space technology and in weather control, they are our contestants. They too are talking of placing a communications satellite in orbit to be used as a fixed TV transmitter for the entire Soviet Union.

We should neither over-estimate their claims, nor wait to be shocked by the next startling advance. It took the first sputnik to push us into an evaluation of our nation's science. Our first positive step was the appointment of Dr. Killian as science advisor to the President, and the establishment of the Science Advisory Committee. Sputnik jolted us into restoring government research funds, cut during postwar economy measures. We appropriated more money for the National Science Foundation. We passed a billion dollar student-loan bill. Indeed, we have seen science gain full stature for the first time in government deliberations. We recognize that our future depends upon intellectual leadership.

These are forward steps, but we see many areas in which we have lacked vision. Being human, and comfortable, we have held back support from many scientific areas which did not promise obvious and prompt rewards. In an article in *Science*, March 27, Lloyd V. Berkner lists some examples. We have not been hastening research which would lead to weather modification, although, if achieved on a large scale, this would have deep social, military and economic consequences. An adequate laboratory for such research would require about $15 million a year, yet our meteorological research goes along on $3 million a year. It is said that a 10% improvement in seasonal weather forecasting alone would save the petroleum industry $100 million yearly, not to mention that for agriculture, transportation, and other business.

Our oceanographic endeavors are small. The Soviet Union has 22 superbly fitted oceanographic vessels. We use a half-dozen old yachts. The Russians, according to the *New York Times*, have a complete oceanographic map of our Pacific Coast.

Our Geological Survey is meagerly supported. The Soviets are said to be coring their continental strata at the rate of 200 deep holes each year. A three-dimensional map of a continent would mean that its resources could be assessed reasonably quickly.

In these and other areas, large-scale, long-term planning is needed with the kind of support demonstrated by the IGY. Global meteorology can be understood only when studied on a global scale. Many of the projects we need to undertake require funds and organizational machinery we do not have. To acquire it, we must evaluate the impact of science on the government in all aspects: social, military, and economic, and assess the national program of science to insure adequate support for all research areas. We must think of research and development as a national matter.

During World War II, we cooperated with the best we had, concentrating on the goal of victory. Now we must learn to cooperate again. Research is our instruument. We must enhance the free exchange of ideas and knowledge, for this is the first requirement of progress. Since great ideas are the treasure of no one nation, we must admit ourselves to the benefits of international exchange. In research, as in trade, we must recognize the inevitable integration of the free world.

We must find the means to utilize our scientific personnel. High competence is rare. We cannot afford to waste it, nor to waste the talents of our next generations. Only a small percentage of our college graduates work for doctorates in natural science. Despite the increasing emphasis on science, the ratio of doctorates in natural science to doctorates in other fields has not changed since 1932.

There are about 35 universities in the Soviet Union. Half of these are of high level and equipped with modern research laboratories. About 170,000 students are enrolled; about 30,000 of them are natural scientists. This is impressive, but if we need to improve our educational programs, it is not by imitating the massive Soviet system. Indeed, they have told us as much. A leading Russian scientist in polymer chemistry gave this comment to a visiting American professor:

> "We are building up an organized educational system to train a large number of youngsters who represent a respectable level of scientific initiative and knowledge, but we do not know whether we shall succeed to develop at the same time, the leaders for this new generation. The only country which has been able to produce a generation of future leaders in our field is the United States; we are therefore looking forward to profit from your educational experience, and shall not hesitate to adopt the methods which have been so successful in your country."

Whatever the difficulties with the Russian education system, its magnitude shows what heavy bets they lay on science. It should be obvious that our science and technology is our biggest asset for the future, and why we must consider our scientific effort as a whole.

Many people are suggesting that we establish a Department of Science and Technology. Some feel that this is the only way we can have a national policy for the support of science in our many government departments, in education, in non-profit institutions, in industry. Not that such a department would be the sole coordinator of scientific activity in the government, but it would give us an agency to serve as a central source for scientific information, for letting of contracts, and decision making. Whether a science department could do all that people claim, I am not sure. Before a bill goes to Congress, all of the pros and cons will be discussed. It is plain that we must have a national policy supporting science. This is clear, but it is going to take extensive planning and funds. Some will claim that we cannot afford such a science program, however, it is our defense. We must be able to afford it! And not only within our own boundaries. The scientific strength of the entire free world should be integrated.

As Vannevar Bush has said:

> "If we lose our liberties it will be because we abandon them. It is a hazardous world; it has always been a hazardous world, beset by the perils of harsh nature, and the greater perils of harsh men."

Harsh men have thrown us the challenge and the United States is answering.

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The Changing Character of Chemical Research in Government

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(Presented [here slightly condensed] at the 36th Annual AIC Meeting, at Atlantic City, N. J., May 7, 1959.)

THE national economy is synonymous with the national well-being and security. We have only to recall the apprehensions that pervaded the public mind little more than a year ago to realize how greatly and how rapidly we are affected by relatively small fluctuations in the nation's economic health. Further, chemical research is of basic importance to a strong and productive economy.

However, the significance to the economy of chemical research conducted by the Government is not self-evident. There are those who question whether research should be conducted in Government laboratories, but no one seems to question the necessity of Federal support of scientific research. It was not always taken for granted that the Government should use public funds for research. The intent of the clause in the Constitution that empowers the Federal Government to levy taxes for "the common defense and the general welfare" was much debated in the early days of the nation. Of the two objectives, "the common defense" could hardly have been a point of dispute, but "the general welfare" was another matter.

In a virgin country, with unlimited natural resources, the myopic view that the general welfare was to be procured from the soil, the forests, and the mines . . . must have seemed instinctively right. But there were some who shared Alexander Hamilton's view that the individual and local pursuit of the general welfare were not enough. Quite early it was decided that trade and commerce among the states must be free of customs barriers and be facilitated by uniform weights and measures. Gradually Congress began to see the possibilities of science and technology as a means of promoting "the general welfare." At first the efforts of science were essentially descriptive, the collection of facts about plants, animals, and minerals, combined with the geographical and geological explorations that opened to use the new lands acquired.

In connection with this cataloguing of resources, an important European development in chemistry was to have strong impact. This was the publication, in 1840, of Liebig's work "Chemistry in its Applications to

Agriculture and Physiology." To quote Dr. Dupree: *

> "By placing the knowledge of the composition of soil on a chemically sound basis and by connecting this with the nutritional needs of plants, Liebig pointed to a general and direct application of science to agriculture. More important than his actual scientific work was his great ability and zeal as a publicist. His works carried the gospel of soil analysis far beyond scientific circles. His laboratory at Giessen became the mecca for young American chemists, who worshiped at the feet of the master and then returned to preach the word to their native land. The agricultural press went wild about soil analysis and promised direct and easy results which could not possibly follow, so that by 1860 a general disillusion prevailed about the immediate usefulness of soil analysis; but the larger validity of chemistry as a weapon against soil exhaustion remained."

This recognition of the potentialities of scientific research to promote agriculture resulted in the establishment, about 1850, of a Division of Agriculture (in the Patent Office) which, 40 years later, evolved into the Department of Agriculture. Zachary Taylor and Millard Fillmore endorsed the growing attention by the Government to research in the promotion of agriculture and emphasized the importance of chemistry.

So we find in agriculture the first application of a Government program of research in chemistry. From the 1850's on, this trend was paralleled by the movement which culminated in the law establishing the land-grant colleges, where instruction in the sciences underlying agriculture and animal husbandry and research in these sciences became important factors in the 100-year effort which has made the U.S. the richest agricultural nation in the world . . .

Let us consider the introduction of chemical research into another segment of the national economy. The early geographical and geological explorations, to attain full usefulness, began to require the detailed studies of the mineralogist and the chemist. About 1880, in the U.S. Geological Survey, a young chemist who had studied with Bunsen began the chemical analysis of rocks and minerals. Because these are complex substances and because W. F. Hillebrand was research-minded, his program yielded as a by-product a highly advanced system of inorganic analytical chemistry, which earned for him recognition as the nation's foremost analytical chemist. Also in the Geological Survey then was Frank Wigglesworth Clarke, who had little taste for laboratory research but who appreciated the usefulness of collecting and interpreting chemical data. Clarke's great contribution to science was *The Data of Geochemistry,* an epoch-making book that is only now being revised by the Survey.

. . . The work of Hillebrand and

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*A. Hunter Dupree, *Science in the Federal Government,* Harvard University Press, 1957, pp 111-112.

Clarke was devoted to obtaining basic information, but the needs of applied science, including chemistry, in the mining industry were recognized. They resulted in the creation of a Division of Mines and Mining of the Geological Survey, which in 1910 became the Bureau of Mines, and which has made great contributions to the general welfare during its existence. Here one sees the published evidence of continuous adaptation to changing needs, from those of coal chemistry, to petroleum technology, to the study of oil shales, to the production of liquid fuels from coal, to titanium and zirconium metallurgy, as the changing scene of metal and mineral technology required. Note in the sequence of examples two types of response. One was to the needs of a decentralized industry such as coal mining, formerly made up of many small individual enterprises. The other was to anticipated national needs in areas too new to stimulate the investment in research of private capital.

About 1900, a development in chemical research in the Department of Agriculture occurred that was inherently different. At first, chemistry as applied to agriculture was stimulated by the aim of conserving and using the natural resources of the soil and the wealth it produced. This was research in support of the producer, who was some millions of proprietors of small farms, where the processing of agricultural products into foods was done by the farmer or his wife. As the nation moved toward industrialization, the production of processed goods shifted from individuals to corporations. In this new industry the producers of processed foods flourished, but consumers often suffered from lack of acceptable quality —sometimes to the point of endangered health. Upton Sinclair wrote *The Jungle* primarily as a novel of social protest, but the book exposed the revolting uncleanliness often found in the meat-packing industry of that day.

Once again the constitutional principle of expending public funds for the common welfare was invoked. Funds were provided for a meat inspection service. A long and hard-fought battle for a Pure Food Law was successfully won under the leadership of Harvey Wiley, one of the truly great leaders in American chemistry. Then it became necessary in the Bureau of Chemistry of the Department of Agriculture to devote time and money to research on methods of testing processed foods, and drugs, that would serve as the basis for enforcement of the Pure Food Law. Here the emphasis was on consumer protection, rather than on assistance to the producer.

It is interesting that the Food Law was the first important setback to the principle of "caveat emptor" in American commerce. There has been some extension of Government inter-

vention in the interest of the consumer since then, but mainly for the protection of health. There has been a steady forward progress, as shown by repeated revision and amendment of the Food and Drug Law, and a general agreement that this kind of Government regulatory activity is indispensable.

Now we turn to the use of public funds for the general promotion of industry and commerce. At the end of the 19th Century the U.S. was well on the way to industrialization—processing raw products of the soil, the forest, and the mine, into a complex and intricate variety of goods that we now see as the index of our standard of living. The concurrent expansion of science and technology was paradoxically both cause and effect of the industrialization. The two came along together. Now we clearly recognize the interdependence of industry and scientific research.

The application of physics, mechanics, and chemistry to the industrialization of Great Britain, Germany, and the U. S. showed the need for standardization of dimensions, properties, and composition in the complex array of goods being produced. Commerce in sophisticated goods cannot proceed unless these goods are defined in quantitative terms that have the same meaning to buyer and seller. Standardization thus becomes a natural function of a neutral agency to facilitate the exchanges between buyer or seller. The recognition of standardization of measurement as a function of Government occurred about the same time in industrial nations. The National Physical Laboratory of Great Britain was established in 1899; the corresponding institution in Germany a decade earlier, and the National Bureau of Standards in the U. S. in 1901. In addition to the governmental functions of maintaining standards of weights and measures, all took the further step of recognizing that these were but the beginnings of an adequate program of standardization of physical and chemical quantities.

The National Bureau of Standards addressed itself first to the standardization of electrical units. The unit of electromotive force, the volt, is defined in terms of the electrochemical equilibrium that exists in the Weston Cell. To make this device reliable and reproducible everywhere required that the chemical components of the cell be of known and reproducible composition. Thus much effort was expended on the preparation of highly pure cadmium sulfate. Then came a demand for a pure substance that would serve to standardize fuel calorimeters, for there was little point to defining a heat unit unless it could be readily applied to the industrial evaluation of fuels. So the Bureau's standard of benzoic acid came into being. The assaying of iron ore and the quality control of iron and steel

involved the use of oxidation-reduction reactions, defined in quantitative terms. So sodium oxalate was introduced, about 1912, as a reductimetric standard. Other standard substances were made available as time went on.

Such standards served to provide reproducible measurements of chemical phenomena, such as oxidation, acid-base equivalence, combustion, and hydrogen-ion activity. There soon developed a need for other chemical standards which have attained extremely wide use—the standards of chemical composition. The need was first felt by the American Foundrymen's Association, whose members found themselves frustrated by disputes about the chemical composition of their products. Help was finally sought from the National Bureau of Standards, whose chief chemist was the same W. F. Hillebrand referred to earlier. The Bureau took over the pig-iron standards from the Foundrymen's Association, and thus initiated what has grown into an extensive program of providing standards of chemical composition for a wide variety of materials. There are now some 600 kinds of standards issued, mainly chemical, and the number of individual samples sold annually is about 55,000. The demands for extension of the service at times severely tax the Bureau's facilities to meet them. The central purpose of these standards is to permit chemical analysis by comparative rather than by absolute measurement . . .

Three other categories of chemical research in the Bureau offer themselves as examples of response by Government to changing needs. The first is the extensive effort that went into the development of methods of testing applicable to purchase-specifications for the great variety of supplies the Government purchases. The individual or the corporate purchaser of goods may make completely free choices of suppliers. Uncle Sam does not have this advantage. His procurement procedure is based on the doctrine that every citizen has a freely competitive right to supply the Government's needs. To insure fair competition among suppliers and to protect the Government's interest as purchaser, the procurement official must have purchase specifications that describe commodities in unambiguous and undebatable terms. He must also be sure that the specifications are complied with . . . Early in this century, Government procurement problems forced attention to the testing of purchases. The effort was not on behalf of the purchasing public but on behalf of the people at large as a corporate purchaser of commodities. It was first exercised for the civilian agencies in the Contracts Laboratory of the Bureau of Chemistry, in the Office of the Supervising Architect (Treasury Dep't), and in the Geological Survey; but about 1915 it was transferred to the National Bu-

reau of Standards. At one time this work was a large part of the chemical activity of the Bureau, but Government procurement by civilian agencies has now grown so large that a specialized agency, the Federal Supply Service, was created. The development of testing methods for purchase specifications consequently has declined to a low level in the Bureau.

The industrialization of the U. S. that began in the latter part of the 19th century did not wait until a foundation of industrial research had been laid. The rapid expansion and diversification of industry resulting from the involvement of the U. S. in the First World War marked the beginnings of industrial research in this country. Industries related to optical glass and dyes, for example, were forced into research activity when trade connections with Germany were broken. Then industrial research accelerated rapidly. But from 1915 to 1930 there was a demand in many areas for industrial research to be done by the Government. Small and with many responsibilities, the National Bureau of Standards pioneered in several areas of research: Optical glass, textiles, paper, ceramic ware, leather, sugar, and Portland cement. Even the realization of petroleum as a source of chemicals got an impetus from a project conducted jointly by the Bureau and the American Petroleum Institute. But as industries saw research as essential to their growth and survival, demands on the Bureau for industrial research have diminished.

The Act of Congress creating the National Bureau of Standards in 1901 also provided that the Bureau should determine, "physical constants and the properties of materials, when such data are of great importance to scientific or manufacturing interests and are not to be obtained of sufficient accuracy elsewhere." Except for the classical determination by W. A. Noyes of the combining ratio of hydrogen and oxygen, little work was done on physico-chemical constants and properties in the Bureau's early years.

The need for such work was not evident until the National Research Council undertook, in the early 20's, the publication of the *International Critical Tables,* of which E. W. Washburn was editor. He had ample opportunity to see the gaps and uncertainties in the existing literature on the properties of substances. When he came to the Bureau in 1926, he sought to remedy some of the glaring deficiencies. He set to work on a systematic program of the measurement of the chemical thermodynamic properties of a number of substances of fundamental chemical interest. The accuracy he achieved was better by at least an order of magnitude than that of previous work. The selection of substances was such that there would be a fundamental network of data to

provide a basis for extension of the results to many other substances by calculation rather than by experimental measurement. The lean years of the 30's and the exigencies of the war years, greatly slowed this program, but the work is still going forward because the results do not appear "to be available of adequate accuracy elsewhere."

Mention should be made of the part chemical research in Government agencies has played in fostering public health. Medical research by the Government began as an aspect of the military necessities of the Civil and Spanish wars and achieved brilliant success in the conquest of yellow fever. In the last 20 years medical science has depended strongly on an understanding of the chemistry of life processes and on the use of chemical agents to combat disease. Phenomenal progress has led to great public interest in and support of research. Congressional appropriations to agencies as the National Institutes of Health have been liberal. Fortunately, biochemists and other scientists of high caliber have been coming out of our universities in substantial numbers, so we have confidence that the money will be well spent and victory over many diseases hastened.

I have not heard anyone say that chemical or other scientific research done in Government institutions has not been justified. This review has shown that economic and social conditions of the times did in fact justify such work, and that its conduct has been responsive to changing needs. What of present and future needs? Can these be met adequately by the laboratories of industry, universities, endowed institutions, and that new type of agency—the privately managed institution mainly supported by Government funds? The nation has, in such agencies, a wealth of scientific and technical resources incomparably greater than at any time—resources that are indispensable in the applications of science to a sound economy.

However, the needs are incomparably greater, and all our scientific resources must be used to maximum advantage. If during the leisurely advance of science prior to World War II, industrial, Government, and privately endowed laboratories were needed to supplement the university laboratory, it is reasonable to believe that this mutually complementary patter will continue to be useful.

How does that recent invention, the privately managed laboratory largely supported by public funds fit this pattern? This kind of institution was created to meet the need of prompt exploitation of nuclear science and technology. No existing Government laboratory could have met this need. In view of the success they have attained, institutions of this new type are considered to have a much wider usefulness in meeting the nation's needs for research. This may be true,

but it does not follow that they can supplant the Government-operated laboratory. They do not answer quite the same purposes . . . Their most basic problem is that there is not a sufficiently direct accountability to the source of the operating funds. And it is not yet known whether they will prove sufficiently adaptable to changing needs. Congress is certain to exert in the years ahead more direct control over expenditures in these privately operated, Government-supported institutions.

That direct management of such operations by Government agencies may be a satisfactory alternative is evidenced by the history of the National Advisory Committee for Aeronautics, now the National Aeronautics and Space Administration. The NACA was in fact a committee, created during World War I, to give guidance to Government agencies in the development of aviation. This new branch of technology grew slowly, in contrast to the nuclear technology of the second war. Thus it was possible for NACA to convert itself in orderly fashion from an advisory group to a large operating agency, with an admirable record of accomplishment in keeping the U. S. abreast of world wide developments in the science and technology of aviation. Perhaps the time is here to begin an orderly conversion of some of the Government-supported, privately operated, research to direct Government operation.

Needs for research in support of the general welfare will continue to emerge. There is a need that confronts us now for research that will require Government support or direct Government operation. I refer to an extensive program of highly accurate measurements of the properties of the basic materials on which our technology rests. It is an area that has been too much neglected during recent years. It is a common experience that handbooks and tabulations of data seem to lack specific information that one wants to have—or it is of questionable reliability. These deficiencies are of vital concern. This will be obvious, if we consider some of the things that have happened to chemistry in the past 30 years. Not so long ago chemistry treated the elements as divided into two classes, the useful ones and the curiosities. The collection of data on their properties and compounds was limited to the "useful ones." By modern standards, the techniques of measurement that were used were primitive.

Chemistry has undergone an explosive expansion. Today there is scarcely an element that does not have technological applications, and for some we even differentiate among their isotopes. Also, there are whole new domains in the chemistry of familiar elements such as silicon, boron, and phosphorus. Chemistry has become again an exploratory science, as it was in the mid-19th century, with

little time given to the orderly and systemic accumulation of precise knowledge on the properties of multitudinous new compounds. Here is a deficiency that must be remedied if chemical technology is to meet modern needs.

We also need to extend our knowledge of properties to new ranges of temperature and pressure. Modern technology requires the use of materials at very high or very low temperatures and often at high pressures. We need to study many materials, not only in conventional state of aggregation but in the specialized condition of single crystals with known or controlled deviations from perfect lattice geometry.

If such information were available, intelligent design might supplant trial and error in our use of materials. Here is a large area of research that needs to be done in the common interest, and that can best be done by an effort that has its focus in a central agency such as the National Bureau of Standards.

A necessary condition to the success of such an effort is that the program be kept sensitive to changing needs by close contact with the entire technical community. History has shown that this kind of effort makes large returns to the general welfare. Its continuance and growth require the encouragement and support of those elements in our society most capable of understanding its significance —the scientists and the engineer.

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Lac Frigidum cum Belle
Coffea Arabica Decoctus Lac

The scholarly tendencies of Theodore R. Donlan, F.A.I.C., of Esso Research and Engineering Co., Linden, N. J., manifested themselves in the above menu for the New Jersey Chapter Award dinner to Dr. Vlon N. Morris. (*See page* 275.)

Research— Its Growth, Its Significance, and Its Problems

Dr. Carl F. Prutton

Executive Vice President, Food Machinery & Chemical Corp.,
161 *E. 42nd St., New York* 17, *N. Y.*

(Presented at the 36th Annual AIC Meeting, at Atlantic City, N. J., May 8, 1959)

FROM its earliest days, the United States has been noted for its outstanding inventors, men like Benjamin Franklin, Thomas Jefferson, Eli Whitney, Edison, Morse, Westinghouse, Colt, and many others, who demonstrated superior talents in the creative fields. Each combined with his own creativity the smatterings of scientific and technical knowledge then available and, usually with laborious experimentation, brought forth new and improved devices sorely needed by mankind. These men clearly established the U.S. as a leader in the field of new technology and inventive genius, and furnished the base upon which many of our fundamental industries were founded.

In the electrical and communications field, and in several narrow segments of the mechanical field, groups of capable men were organized to carry on and expand the earlier developments of the individual inventors. Bell Telephone, General Electric, and some of our larger corporations, owe their growth and prosperity to the ever-accelerating research programs which had their origins in the work of our pioneer inventors. A competent observer should agree that if the research activities of these companies had not been fully developed over the intervening years, the rate and soundness of their tremendous growth would have been greatly impaired.

This country seems to require major military conflicts to arouse us from our complacent peacetime progress. In World War I, the excellence and importance of German chemical research were demonstrated. It became obvious that superior research prowess and the necessary industrial backup for research developments were primary requirements for waging a successful major war. Based upon these teachings, we initiated activities which, over several decades, have given us an outstanding chemical industry based upon a sound and adequate organic chemical research program.

In World War II, we again had proven to us that we had been asleep between wars in the field of research on new military equipment and materials and methods needed for waging war against a technically proficient, strong adversary. With desperate ef-

fort, we successfully overtook the lead of the Germans in synthetic rubber and military aircraft; then surpassed them in other areas including nuclear weapons, and electronics.

We finally realized that, as a requirement for survival, we had to continue a productive and intensive research and development effort in all fields related to military methods and equipment, and to back this up we needed sound national industries with superior research organizations.

The Korean episode and subsequent events proved to us that for the indefinite future we were up against a strong, implacable enemy, dedicated to overpower us militarily, politically and economically by their strength in research and technology, backed by industrial might.

Our research activities have thus grown in somewhat erratic fashion, and in several major areas were largely initiated through external military and industrial competition. In the future we must be self-starters, if we wish to maintain our position as world leaders. We must lead in research as well as in other fields.

My personal definition of research is broad, covering all aspects, from the generation of basic principles and facts up to the large scale commercial use of the new product or process.

Since the beginning of World War II, we have had an ever-increasing military research and development program, and today are expending somewhat over 1% of our Gross National Product dollars in military research. As the complexity of military weapons increases, as it will, these expenditures must be greatly increased. The development of long-range guided missiles, space platforms, space ships, nuclear submarines and airplanes, new fuels and other essentials will require much greater military research and development expenditures. It is the price we must pay for continuance of our way of life.

Our civilian industrial research program expends annually about 1% of our GNP. This amount must also be greatly increased in the years ahead to meet the rapid changes in technology which will flow from rapidly-accelerating competitive research, and to meet the demands arising from our military activities. It would not surprise me if in 10 years we will be spending for all research and development from 4 to 6% of our GNP, meaning from $20 to $40 billion each year. This great sum if constructively expended in research, is insignificant when compared with the benefits such a program can generate for us, for our descendants, and for the world at large.

Faced with the probability of such a major expenditure, and with our economic and military existence dependent upon the magnitude and excellence of our research and technologic effort, let us consider the principal economic and related im-

pacts of this research program and give consideration to those areas where we must improve management and performance in this great research effort.

Research Changes Our Way of Life

Principal among the impacts of our research achievement is that upon each of us individually. Our entire population is becoming acclimated to rapid technologic change, and these changes affect every individual in our country. Our way of life is changing, producing an ever-mounting standard of living, better foods, superior housing, improved health, new methods of transportation and communication, and greater leisure.

This rapid evolution necessitates that each member of our working population be prepared for occasional adjustments in his employment to fit into the changing needs of industry, business and government. Technical obsolescence of products may close down plants or operations and eliminate the need for many existing skills. However, employment opportunities are continually being created, and special skills are in demand for the manufacture of new and improved products derived from our expanding research.

Based on technologic developments, the improvement of our worker productivity has been from 1 to 3% each year. This change, on one hand, tends to lower employment slightly, but it also serves to enable employers better to pay still higher wages to all their employees. Since our economy is based in large measure upon the purchasing power of all of our people, greater volumes of goods can be purchased and this volume increase adds to total employment.

Our research effort continues to upgrade the work done by our workers. Manual and highly-repetitive labor operations are decreasing, while the design, construction and operation of complex machines and control systems are on the increase.

These various economic effects of research on the individual produce an increased need for better and modified educational programs. One is to train our people for a life of change, and the second is to provide training in the newer skills needed in this changing world. We must provide more adequate training programs for mature workers in order to minimize or eliminate the impact of possible technological unemployment.

The impact of research on our national security and on the well being of our industries does not need further elaboration. However, to realize those higher levels of technological improvement that are necessities for our personal, industrial and national welfares, we must improve our research activities and their administration and utilization. The sudden upsurge of research volume has resulted in much confusion and, in many cases, lowered individual research productivity. We

must learn how to operate our research program at maximum effectiveness, if we expect expansion or even maintenance of our present research level. If we do not expand to meet world research competition, we will face dire consequences.

In many of our industries and corporations, research has finally become integrated with their very existence, continuing growth, and superior performance. No longer is a research worker a long-haired scientist out of touch with the everyday operations and the problems of industry. Statistics show quite clearly the dependence of rate of growth of our industrial corporations on the volume of their research activities. A corporation which neglects research will soon drop from the industrial scene. All investment counsellors carefully scrutinize the research expenditure of a corporation and the new products brought out by that corporation which were derived from its research. This ability to bring out new products based on research is used not only as a measurement of research performance, but also to determine the skill of management in providing general guidance to its research activities so that maximum economic results are realized from research breakthroughs. The conversion of a laboratory achievement into an economically sound commercial venture will be one of the major challenges of our industrial managers.

Management Must Guide Research

Management in too many organizations still does not utilize fully its research possibilities. Many research organizations function with little, if any, guidance from top management. This executive level must provide knowing and understanding supervision, financial patience and adequate funds, particularly in the many months that usually elapse between the time a project shows initial promise in the laboratory, and the time when it finally becomes converted into a profitable commercial venture. Obviously, research objectives must be integrated with commercial and economic planning, if effective conversion of research results to commercial products is to be accomplished.

Research management is still quite deficient in many respects in its inspiration, guidance and organization of our research efforts. Better skills and techniques must be perfected to alleviate the tremendous costs and inefficiencies which lie between a laboratory research achievement and a commercial success.

At the bench level in research, our individual creative research men must be fully indoctrinated in teamwork, and particularly into taking an unbiased view of new ideas and concepts or suggestions, no matter from where they originate. The improved training of research technicians is extremely important for the reduction of the

load of repetitive laboratory and testing work now detracting from the creative productivity of our best research men.

This country has not been sufficiently active in the perfection of research instruments. Superior instrumentation and skilled operators are absolutely esssential in modern research.

More Basic Research Needed

The lifeblood of our applied research program is nourished by the facts and theories flowing from our basic research activities. This stream is too feeble and is not being built up adequately tor even the present level of our military and civilian research programs. Much of this work must be carried on in educational institutions and some in governmental and industrial groups. Both government and industry must assume greater responsibilities than they have in the past in this all-important fundamental research area.

Primary to the entire program of applied and basic research is that of adequate manpower. Well-trained, inspired people in adequate numbers must be provided. Our schools must be built up by financial aid from all sources, by advice on the part of our best minds, and by the encouragement of education by the general public.

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Recognition and Reward Necessary

To make a career in research attractive to our youth, we must give high recognition and reward to the members of this profession and particularly to those who can and do make creative contributions.

In earlier days, many of our creative individuals gained their own rewards by founding large and profitable enterprises. Ford, Edison, and Westinghouse are typical. Today it is a more involved problem to enter business based upon a single research achievement; therefore, to make certain that we attract our finest minds into research, we must make it attractive from an economic standpoint, as well as through recognition of their achievements.

In addition to establishment of rewards and recognition for research achievements, our industries should receive more encouragement from government in the development of new products based on such research breakthroughs. This encouragement could consist of adequate tax considerations, but could also be in the form of aid to fundamental research or to education. Better administration of military research projects con-

tracted out to industry would aid.

These types of incentives seem justified, for from this civilian industrial research and development program, our government reaps many benefits:

An improved military security.

New large areas for additional taxation to pay the ever-increasing cost of government.

A citizenry constantly improving its income, its living standards, and its health.

Greater productivity and economic strength of the nation to better meet several of its major obligations in maintaining adequate military strength and in building up under-developed areas or groups in our own country and abroad.

Two of the most rapidly developing countries, West Germany and Russia, have set up encouragements to accelerate their rate of technologic growth. We should take example.

To summarize:

(1) Our military and political security depends upon research.
(2) Research is the basis of our economic existence and growth.
(3) Research is changing the patterns of our individual existences. Through research developments, we are facing and must face a world of rapid change and growth.
(4) Research expenditures will continue to expand to still higher levels if we solve, as we will, several serious problems connected with our research effort.
(5) Our government and industry must increase their constructive aid to all segments of our research and development program. Present efforts are inadequate for the expanding program which lies ahead.

Through military and industrial developments our research activities have been projected into a vital key spot in public affairs. We must take complete advantage of this opportunity for service to mankind, and of reaping acclaim for our work and achievements. We must face this challenge with confidence, with flexible attitudes to meet changing problems, but with full determination that we must not fail.

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Vlon N. Morris—A True Professional

Dr. W. H. Lycan, F.A.I.C.

Vice President, Research, Johnson & Johnson, New Brunswick, N. J.

(Presented when Dr. Morris received the Honor Scroll of the New Jersey AIC Chapter, April 21, 1959, at the Military Park Hotel, Newark, N. J.)

BORN in Colorado and raised in Indiana, Dr. Vlon N. Morris was educated at Purdue and the University of Minnesota. After receiving the Ph.D. in physical chemistry at Minnesota in 1926, Dr. Morris joined the Firestone Tire & Rubber Company. During his eight years there he quickly rose to the post of head of the Physico-Chemical Research Section.

One of his colleagues of those days, four years his junior and himself a true professional, has written of Dr. Morris, as of those days, in words descriptive of his entire scientific career.

> "Our reason for looking up to him was not his exalted position nor was it his often touted 'seasoned knowledge' of the practical technology of the rubber industry. Somehow he stood out alone above other research people probably because he had such a profound grasp of his specialty, the Johncome-lately field of latex technology.
>
> "But he did not just splash around with his colloid chemistry, as did so many others with theirs. Everything he did was based on scientific principles (these were not too popular in the early '30's.) Little wonder that some of us held him in some awe, in those days when the expedient was often the only apparent means of holding a job. Vlon never seemed aware of these pressures; he just continued to apply his chemistry to the problems at hand and, although he was softspoken, we younger scientists could discern a firm attitude which might be described as 'to hell with minor affairs of the present, let's get on with the bigger things of the future' ".

From 1935 to 1940, Dr. Morris served as research supervisor in the Resinous Products Division of Rohm & Haas Company of Philadelphia. It was on the basis of this vast background of experience in both rubber and resins that he was called upon to organize Johnson & Johnson's newly founded Industrial Tape Corporation's research effort. Starting with only four men, he built in the next 11 years a research staff of over 90 people and the products of his research raised the Industrial Tape Corporation to a status of one of the most important units in the Johnson & Johnson complex.

More recently, after a tour of duty as research director of Shellmar Products Corporation, Dr. Morris was recalled to Johnson & Johnson to serve in liaison capacity between our increasingly diverse research laboratories. Our company is grateful for the wisdom, tact, and patience he brought to this last assignment with us.

Aside from administrative duties and direction of research, Dr. Morris found time to publish many papers in his chosen field. In addition, he edited with Dr. R. F. Dunbrook the American Edition of Memmler's *Science of Rubber;* found time to write the section on resins in Degering's *Outline of*

Some of Dr. Morris' former associates present at the Honor Scroll Award to him.

Left to right in the back row: N. St. Landau, H. M. Sonnichsen, R. L. Lamason, R. S. Norland, W. E. Holland, R. J. Priepke, M. M. Kline, J. A. Chesnut. Beginning with G. J. Crocker (*left front, with glasses*): A. M. Striker, C. W. Bemmels, L. W. Eger, C. L. Weidner. *Seated*: Dr. Morris.

Organic Chemistry; wrote the section on adhesives with Dr. C. L. Weidner and N. St. Landau in Kirk and Othmer's *Encyclopedia of Chemical Technology,* and, finally, wrote the section on "Philosophy of Research Budgeting and Cost Control", in the book, *Coordination of Control and Financing of Industrial Research.*

In the late rainy afternoon of Oct. 6, 1956, there occurred the tragic automobile accident which ended the active chemical career of Dr. Morris. With Mrs. Morris, he was that afternoon starting an annual assignment which he had come to enjoy above almost all other of his many responsibilities. It was that of interviewing the year's new crop of chemists and chemical engineers and of selecting those whom we might invite to join our company.

Although, personally, he never got to complete that mission, it was characteristically his first concern, when I was permitted to see him only a little more than 72 hours after the accident. It was he who selected the men who would conduct the delayed interviews in his place. Only a few days later he dictated letters of apology to the placement officers in the Universities for any inconvenience of scheduling they had suffered.

During previous years, however, Dr. Morris found time for manifold outside professional activities. Long a leader in the affairs of the Raritan Valley Subsection and of the North Jersey Section of the American Chemical Society, he was chairman-elect of that Section when his accident occurred. He was a long-time and active member of the Association of Research

Directors in New York. He remained to the end of his active career, and to this day, a student of and a servant to his profession.

Not only do the companies for whom he worked owe him a debt of gratitude, but so equally do those who worked with or for him. It is particularly fitting that one truly professional among us, Dr. Vlon N. Morris, should receive the Honor Scroll of the New Jersey Chapter of THE AMERICAN INSTITUTE OF CHEMISTS.

Presentation to Dr. Morris

The Honor Scroll of the New Jersey AIC Chapter was presented to Dr. Vlon N. Morris, F.A.I.C., of 4075 Shorecrest Dr., Orlando, Fla., at the Annual Awards Meeting of the Chapter, held at the Military Park Hotel, Newark, N. J., April 21. Dr. Lawrence T. Eby, then chairman of the Chapter, presided.

Dr. W. H. Lycan, vice president, research, Johnson & Johnson, New Brunswick, N. J., introduced Dr. Morris to whom Dr. Eby presented the Honor Scholl. Dr. Morris extended greetings and expressed his gratitude for the award and for the pleasure of seeing so many of his New York and New Jersey friends again.

Student medals, awarded by the Chapter to seniors in area colleges, were presented to the following outstanding students, who were introduced by their faculty sponsors:

Miss Grace E. Willoughby, Douglass College; Faculty sponsor, Dr. Roger Sweet

Richard Kiefer and Conrad Heins, Drew University; Faculty sponsor, Dr. Donald A. Scott

Charles J. Grossman, Newark College of Engineering; Faculty sponsor, Prof. Robert G. Poetz

Gardiner H. Myers, Princeton University; Faculty sponsor, Dr. Clark Bricker

Robert W. Kunze, Rutgers University; Faculty sponsor, Dr. U. P. Strauss

John M. Dear, Seton Hall University; Faculty sponsor, Dr. Ellis V. Brown.

The invited address was presented by Dr. W. O. Baker, vice president, Bell Telephone Co., Murray Hill, N. J. His subject was, "Federal Science and Technology in the U.S.A."

The citation on the Honor Scroll to Dr. Morris reads:

For his inspiration and assistance to scientists as individuals, to their professional organizations and to organized research, for his own contributions to scientific knowledge, and for his quiet insistence on improved status and material value of industrial chemists.

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Friends Departed

Dr. Cash Blair Pollard, F.A.I.C., (1900-1959), died in June. (A.B. William Jewell College; M.S., Ph.D. Purdue). He was professor of chemistry, University of Florida, Gainesville, Fla., and an expert toxicologist, consulted by State and Federal courts in criminal investigation cases. With Dr. E. H. Andrews, he developed a new technique for treating snake bites.

Dr. E. E. Butterfield, F.A.I.C., (1881-1959) died May 16. (M.D., George Washington University; studied at Johns Hopkins University, and under Rockefeller Institute grants, at Munich, Tuebingen, and Leiden.) A retired physician, chemical consultant, writer, his home was in Long Island City, N. Y. He contributed notably to morphological pathology and hematology, spectrophotometry, water and sewage treatment, and to the study of the Lorentz transformations.

Maurice C. Taylor, F.A.I.C., (1894-1959) died June 6. (B.S. Purdue University.) From 1919-1949 he worked for Mathieson Alkali Works, Niagara Falls, N. Y., leaving to establish Taylor Research Labs., a consulting firm. He was a founder and enthusiastic supporter of the Niagara AIC Chapter, which presented him with its Honor Scroll. (See THE CHEMIST, December, 1957).

Marvin J. Udy, F.A.I.C., (1892-1959), vice president and consultant for Strategic-Udy Processes, Inc., died at Niagara Falls, N. Y., April 11. (B.S., M.S., University of Utah; Hon. D.Sc. Alfred University.) Outstanding metallurgist, he developed the first commercial processes for the refining and use of chromium. His cadmium plating process resulted in the formation of the Udylite Process Co. of Detroit.

Charles S. Williamson, Jr., F.A.I.C., (1879-1959) emeritus professor, Tulane University, New Orleans, La., and consulting chemical engineer, died May 11, 1959. (B.S., M.S. Vanderbilt University.) He was active in the Louisiana AIC Chapter.

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Organic Chemists. B.S. or M.S. degree, up to 3 years experience. Work in resin research group; either polyvinyl acetate and related co-polymers or epoxy resins. Strong organic or high polymer background, must be creative. Box 701, THE CHEMIST.

Senior Chemical Scientist. M.S. or Ph.D., physical or physical organic chemistry; experienced in product application; some background in basic research and development. Act as consultant to other groups within the organization. Location New England. Salary to $900 per month. Box 703, THE CHEMIST.

Senior Chemist. B.S. or advanced degree with 7-10 years' experience in physical or physical organic research and development, for research and development work on new concepts for isotope utilization, as design, demonstration and construction of new chemical analytical instruments. Salary to $825 per month. Location New England. Box 705, THE CHEMIST.

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Report On the Licensing of Chemists and Chemical Engineers

Maynard J. Pro, F.A.I.C.

Chairman of the AIC Committee on Legislation, 4414 Franklin St., Kensington, Parkwood, Md.

(AIC members are urged to send their comments on this report to the Committee.)

DURING the past year attempts have been made to license chemists and chemical engineers in the States of Illinois and New York. Notice of these pressures has been reported in THE CHEMIST and at the 36th Annual AIC Meeting in Atlantic City. In these reports, the Committee on Legislation Affecting Chemists and Chemical Engineers has recommended licensing through a National Board, headed by outstanding people in our profession, as a probable solution to the demand by organized pressure groups for licensing action.

Recently, Dr. George L. Royer, F.A.I.C., forwarded to the Committee an editorial series from a New Jersey newspaper concerned with professional licensing. The article reported that a survey conducted by the Council of State Governments showed the existence of a continuing demand for licensing. This group also found that licensing boards in most states have little legislative control, and that the public interest is seldom directly represented. Arguments similar to these have in the past aroused sufficient opposition to State licensing of chemists and chemical engineers.

Although most members of our profession are probably not in favor of State licensing, some action on a national level should be initiated. This is necessary because public pressure will eventually demand partial, if not complete, control of our rights to pursue the occupation of our choice. It is very possible to enact these controls if pressure groups can show the interest of the public is best served by such legislation. This type of thinking is no longer a theory. It has been employed by some of the liberal states as an argument to control rents and mortgages many years after a national emergency has ceased to exist.

The National Committee on Legislation Affecting Chemists and Chemical Engineers would like to hear your views on licensing. The Committee is available for action.

General Mills, Minneapolis 26, Minn., recently held "Fatty Nitrogen" seminars in Philadelphia, New York, Chicago, and Los Angeles, covering the chemistry and applications of the company's long chain fatty amines, diamines, and quaternary ammonium chlorides.

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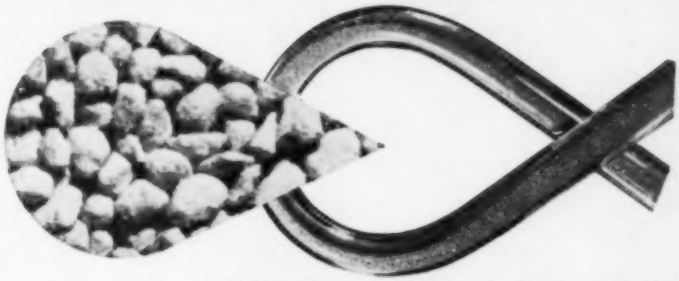

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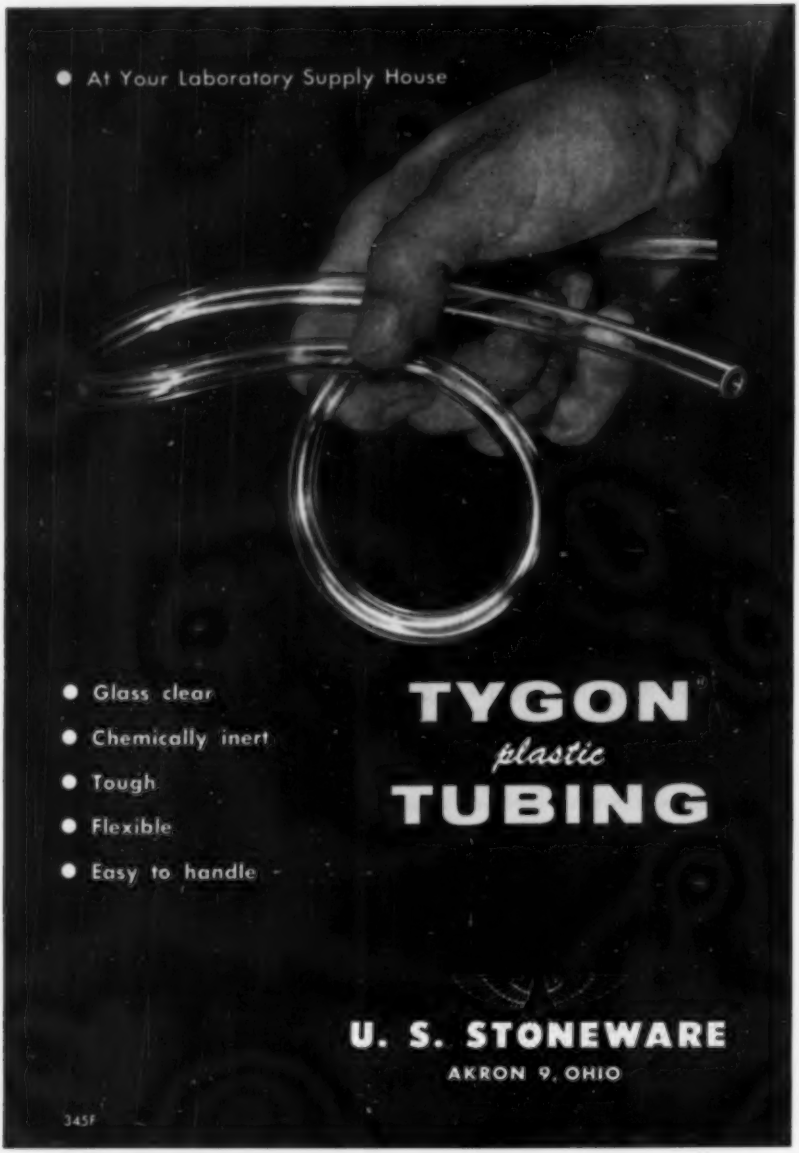
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